FIG. 1

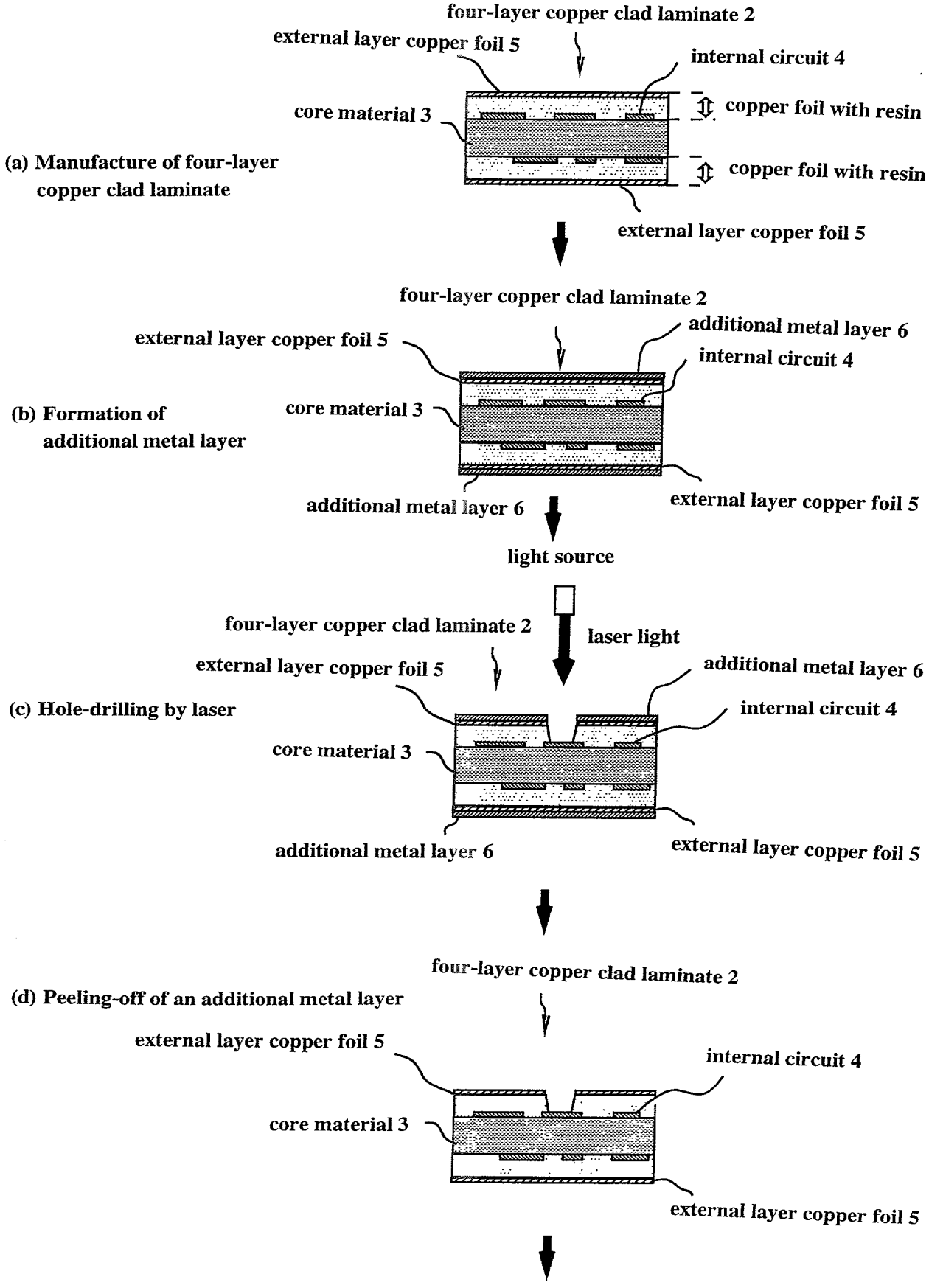

four-layer copper clad laminate 2
external layer copper foil 5
internal circuit 4
core material 3
copper foil with resin
copper foil with resin
(a) Manufacture of four-layer copper clad laminate
external layer copper foil 5
four-layer copper clad laminate 2
external layer copper foil 5
additional metal layer 6
internal circuit 4
core material 3
(b) Formation of additional metal layer
additional metal layer 6
external layer copper foil 5
light source
four-layer copper clad laminate 2
laser light
external layer copper foil 5
additional metal layer 6
(c) Hole-drilling by laser
internal circuit 4
core material 3
additional metal layer 6
external layer copper foil 5
four-layer copper clad laminate 2
(d) Peeling-off of an additional metal layer
external layer copper foil 5
internal circuit 4
core material 3
external layer copper foil 5

FIG. 2

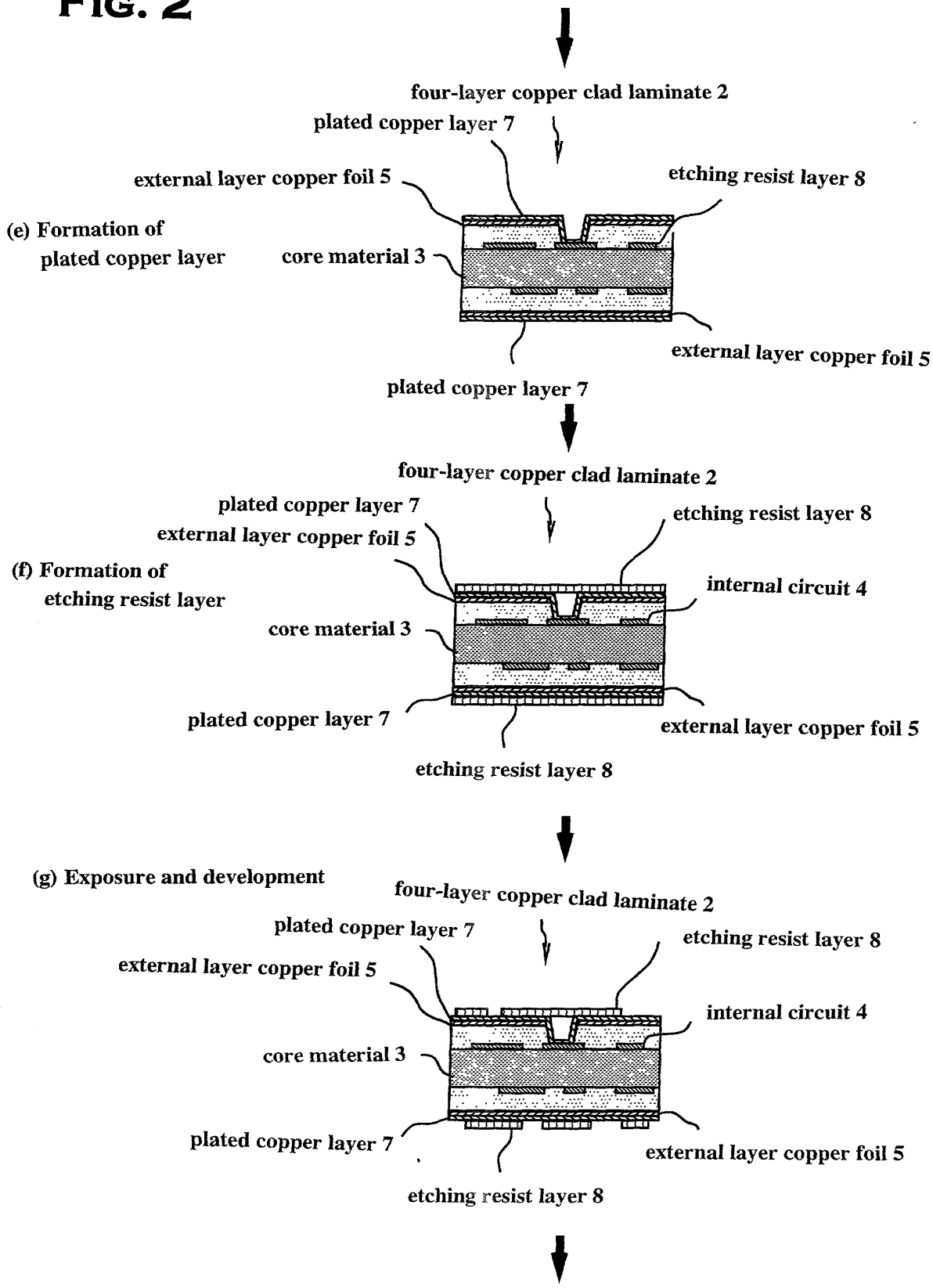

four-layer copper clad laminate 2
plated copper layer 7
external layer copper foil 5
etching resist layer 8
(e) Formation of plated copper layer
core material 3
external layer copper foil 5
plated copper layer 7
four-layer copper clad laminate 2
plated copper layer 7
etching resist layer 8
external layer copper foil 5
(f) Formation of etching resist layer
internal circuit 4
core material 3
plated copper layer 7
external layer copper foil 5
etching resist layer 8
(g) Exposure and development
four-layer copper clad laminate 2
plated copper layer 7
etching resist layer 8
external layer copper foil 5
internal circuit 4
core material 3
plated copper layer 7
external layer copper foil 5
etching resist layer 8

FIG. 3

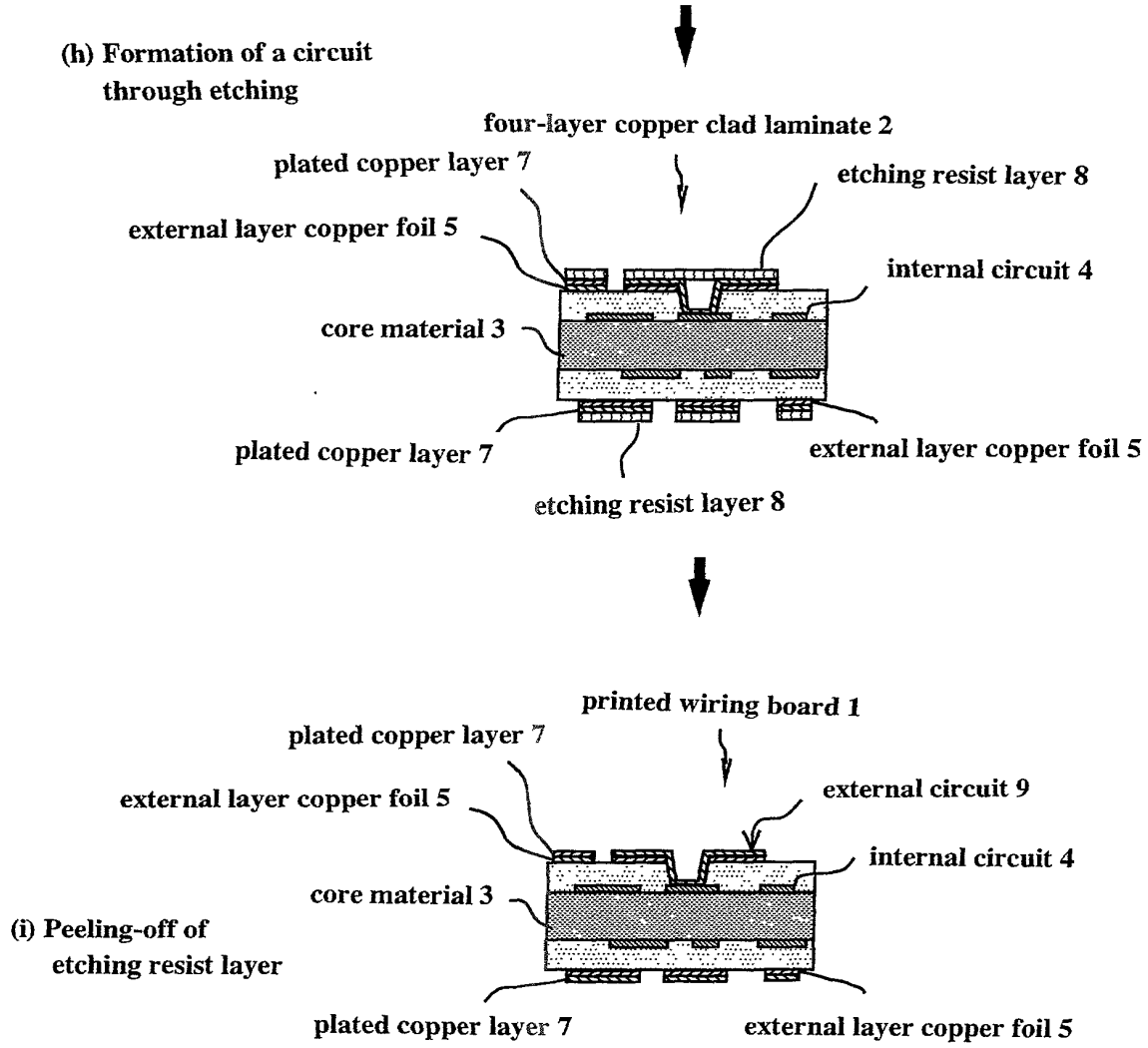

(h) Formation of a circuit through etching
four-layer copper clad laminate 2
plated copper layer 7
etching resist layer 8
external layer copper foil 5
internal circuit 4
core material 3
plated copper layer 7
external layer copper foil 5
etching resist layer 8
printed wiring board 1
plated copper layer 7
external circuit 9
external layer copper foil 5
internal circuit 4
core material 3
(i) Peeling-off of etching resist layer
plated copper layer 7
external layer copper foil 5

FIG. 4

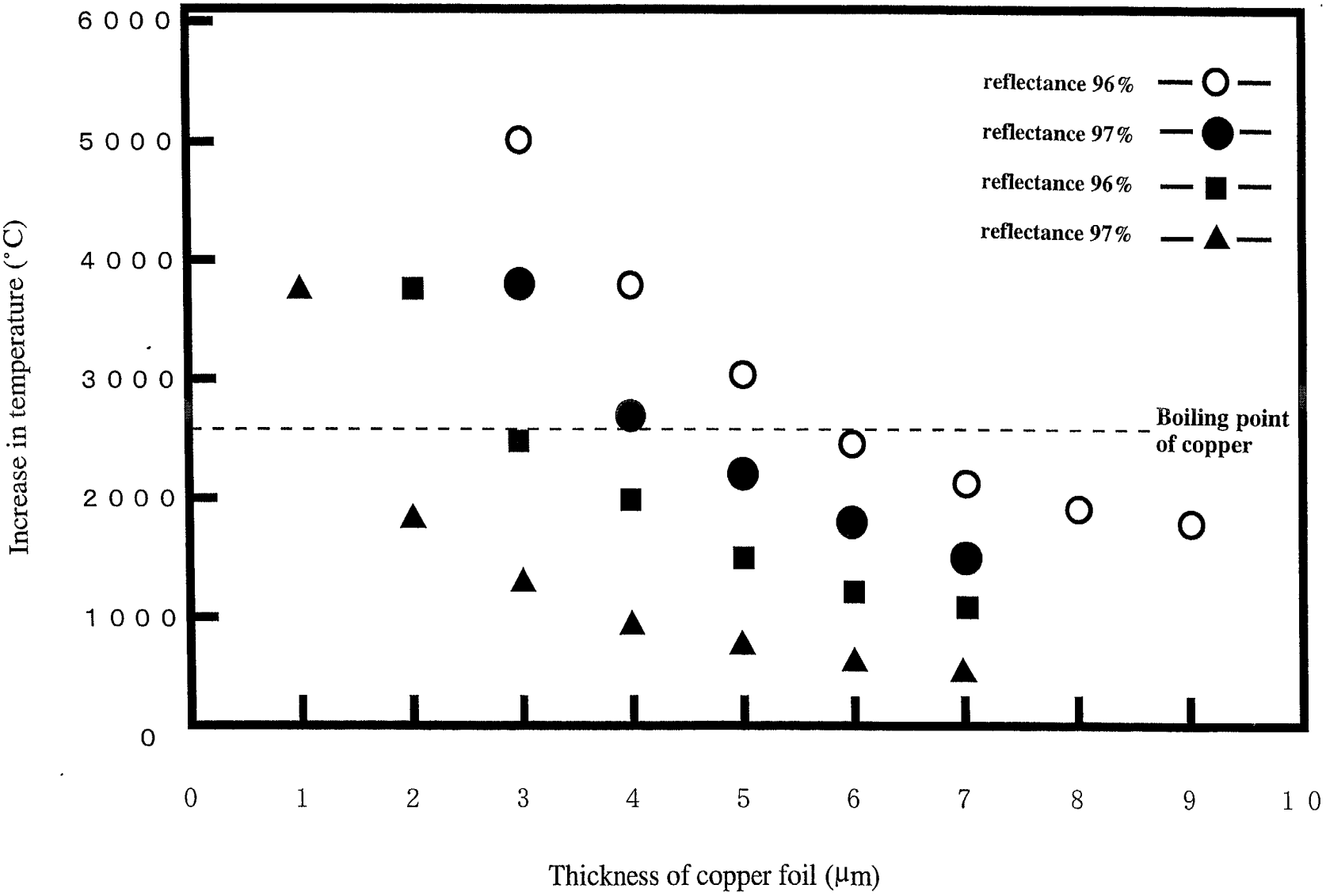


FIG. 5

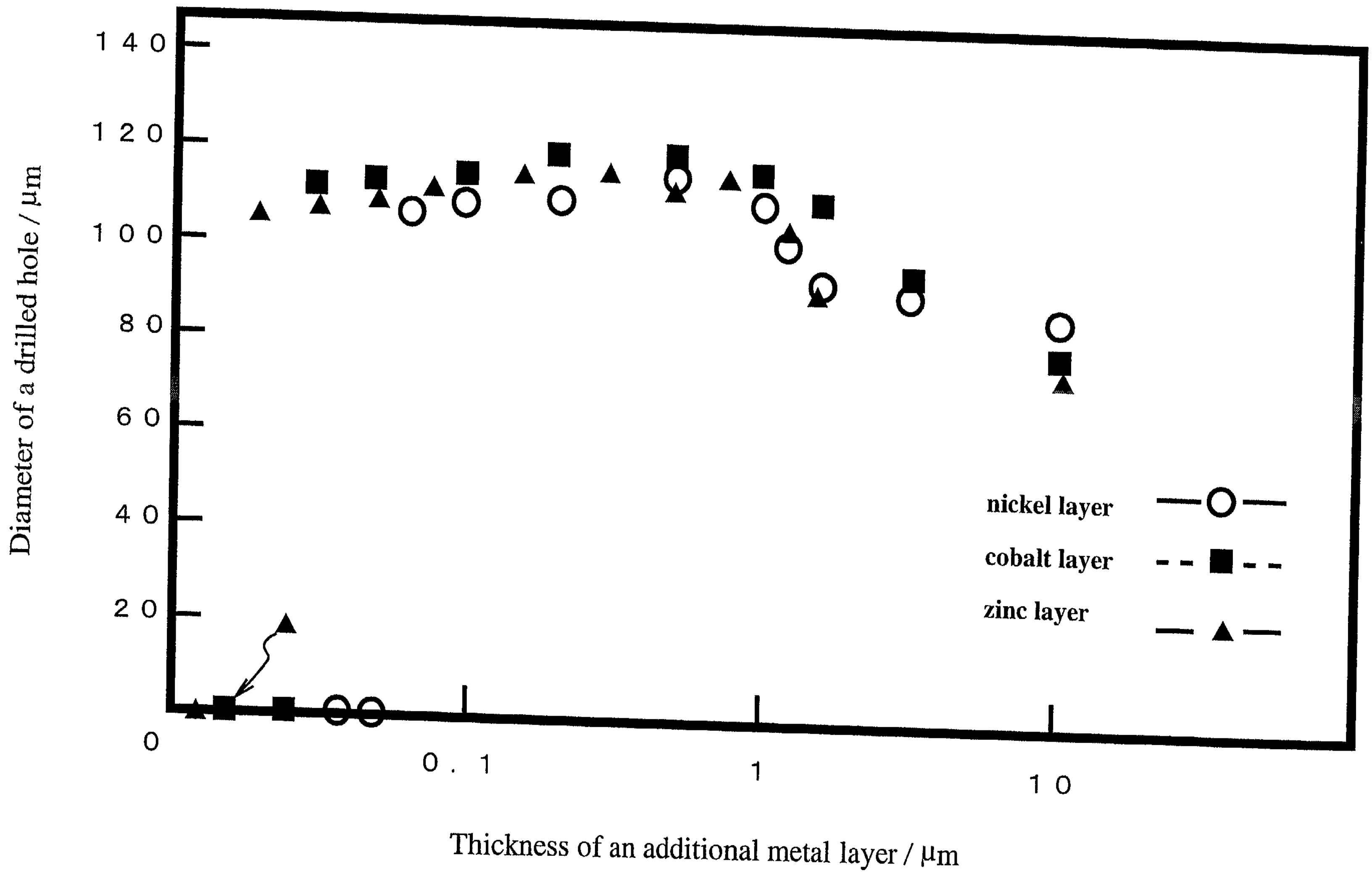

Diameter of a drilled hole / μm
140
120
100
80
60
40
20
0
0.1
1
10
Thickness of an additional metal layer / μm
nickel layer
cobalt layer
zinc layer

FIG. 6

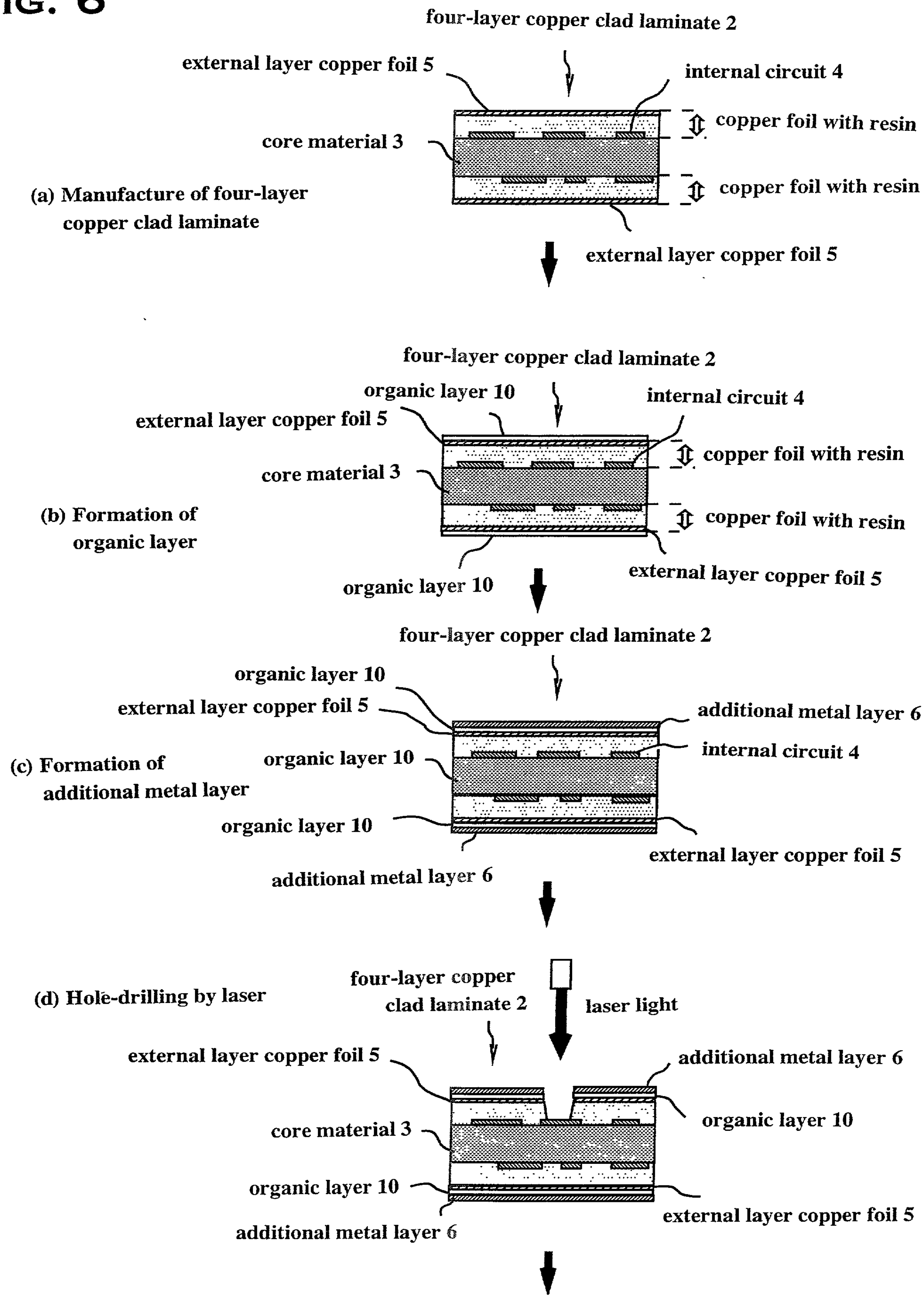

four-layer copper clad laminate 2
external layer copper foil 5
internal circuit 4
copper foil with resin
core material 3
(a) Manufacture of four-layer copper clad laminate
copper foil with resin
external layer copper foil 5
four-layer copper clad laminate 2
organic layer 10
internal circuit 4
external layer copper foil 5
copper foil with resin
core material 3
(b) Formation of organic layer
copper foil with resin
external layer copper foil 5
organic layer 10
four-layer copper clad laminate 2
organic layer 10
external layer copper foil 5
additional metal layer 6
internal circuit 4
(c) Formation of additional metal layer
organic layer 10
organic layer 10
external layer copper foil 5
additional metal layer 6
(d) Hole-drilling by laser
four-layer copper clad laminate 2
laser light
external layer copper foil 5
additional metal layer 6
organic layer 10
core material 3
organic layer 10
external layer copper foil 5
additional metal layer 6

FIG. 7

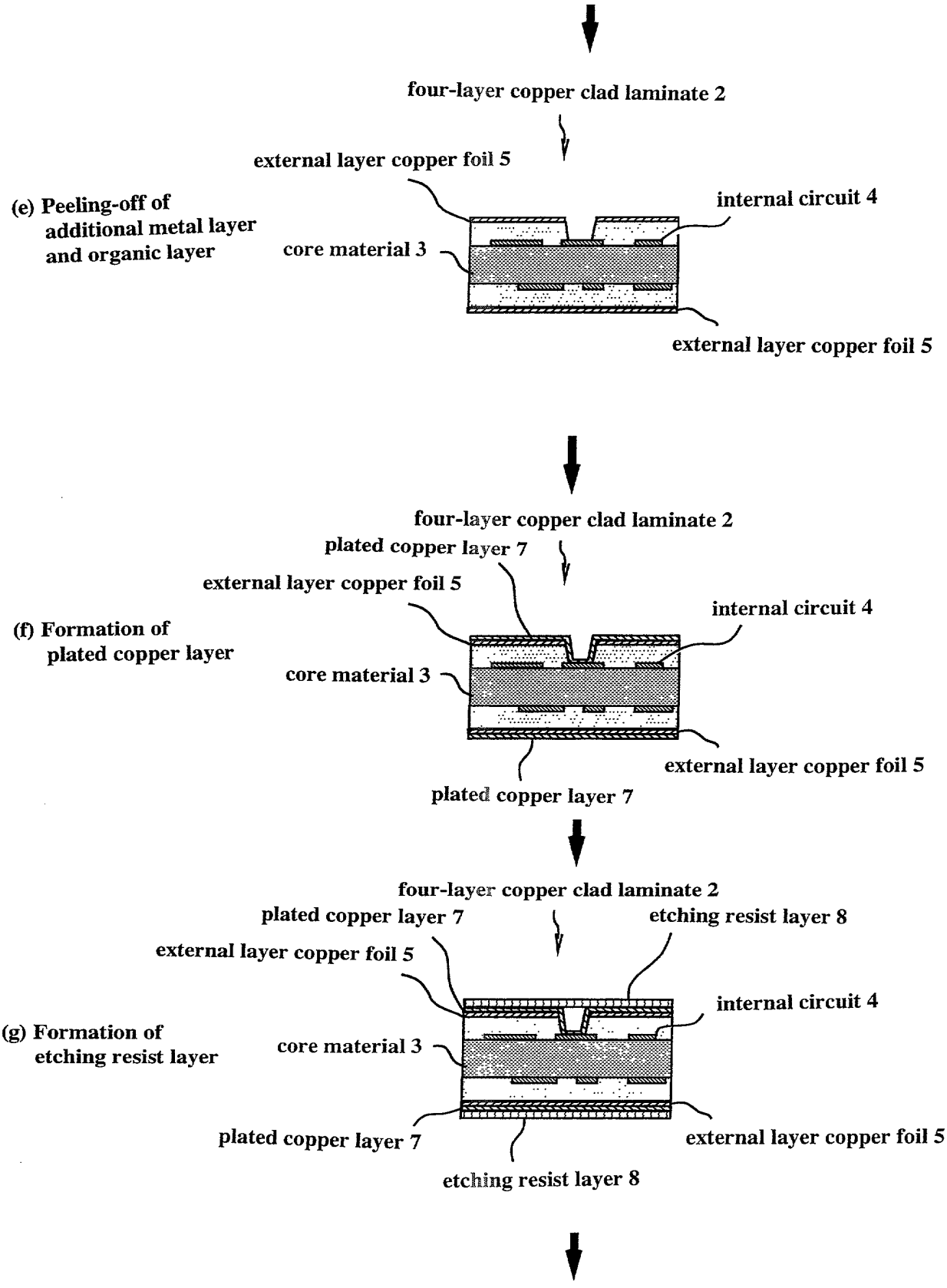


FIG. 8

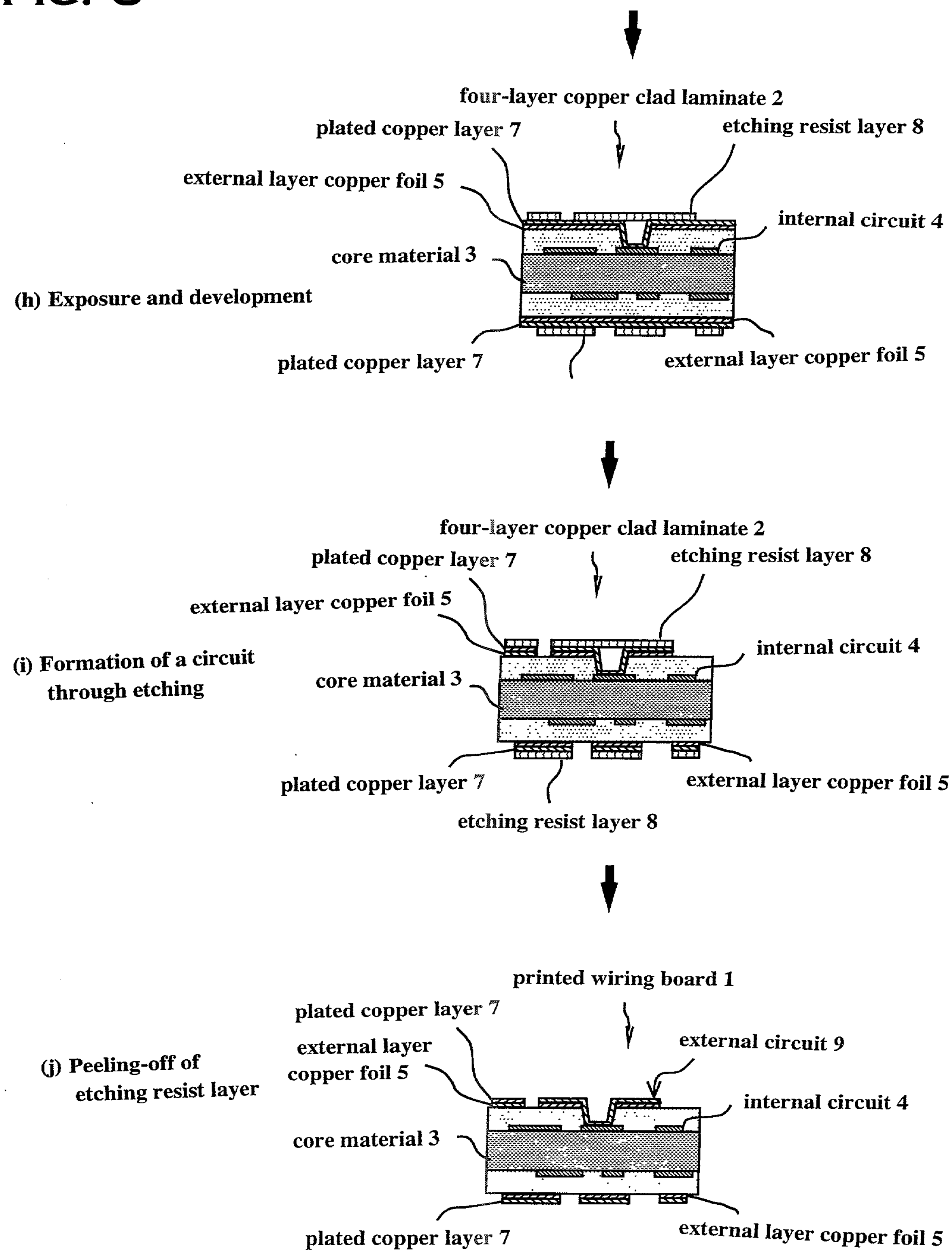

four-layer copper clad laminate 2
plated copper layer 7
etching resist layer 8
external layer copper foil 5
internal circuit 4
core material 3
(h) Exposure and development
plated copper layer 7
external layer copper foil 5
four-layer copper clad laminate 2
plated copper layer 7
etching resist layer 8
external layer copper foil 5
internal circuit 4
(i) Formation of a circuit through etching
core material 3
plated copper layer 7
external layer copper foil 5
etching resist layer 8
printed wiring board 1
plated copper layer 7
external layer copper foil 5
external circuit 9
(j) Peeling-off of etching resist layer
internal circuit 4
core material 3
plated copper layer 7
external layer copper foil 5

FIG. 9

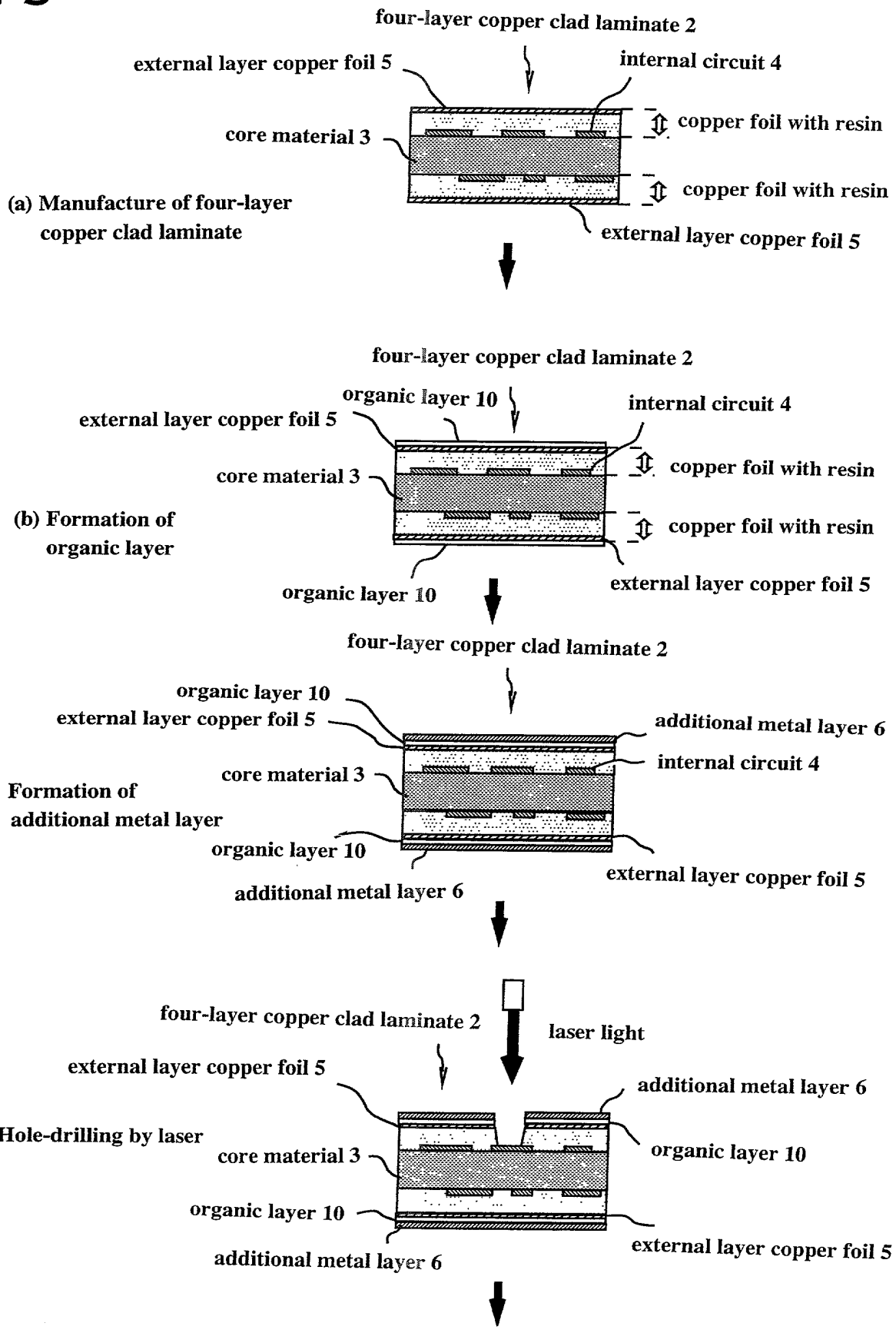

four-layer copper clad laminate 2
external layer copper foil 5
internal circuit 4
core material 3
copper foil with resin
copper foil with resin
(a) Manufacture of four-layer copper clad laminate
external layer copper foil 5
four-layer copper clad laminate 2
organic layer 10
internal circuit 4
external layer copper foil 5
core material 3
copper foil with resin
copper foil with resin
(b) Formation of organic layer
organic layer 10
external layer copper foil 5
four-layer copper clad laminate 2
organic layer 10
external layer copper foil 5
additional metal layer 6
internal circuit 4
core material 3
(c) Formation of additional metal layer
organic layer 10
external layer copper foil 5
additional metal layer 6
four-layer copper clad laminate 2
laser light
external layer copper foil 5
additional metal layer 6
(d) Hole-drilling by laser
core material 3
organic layer 10
organic layer 10
external layer copper foil 5
additional metal layer 6

FIG. 10

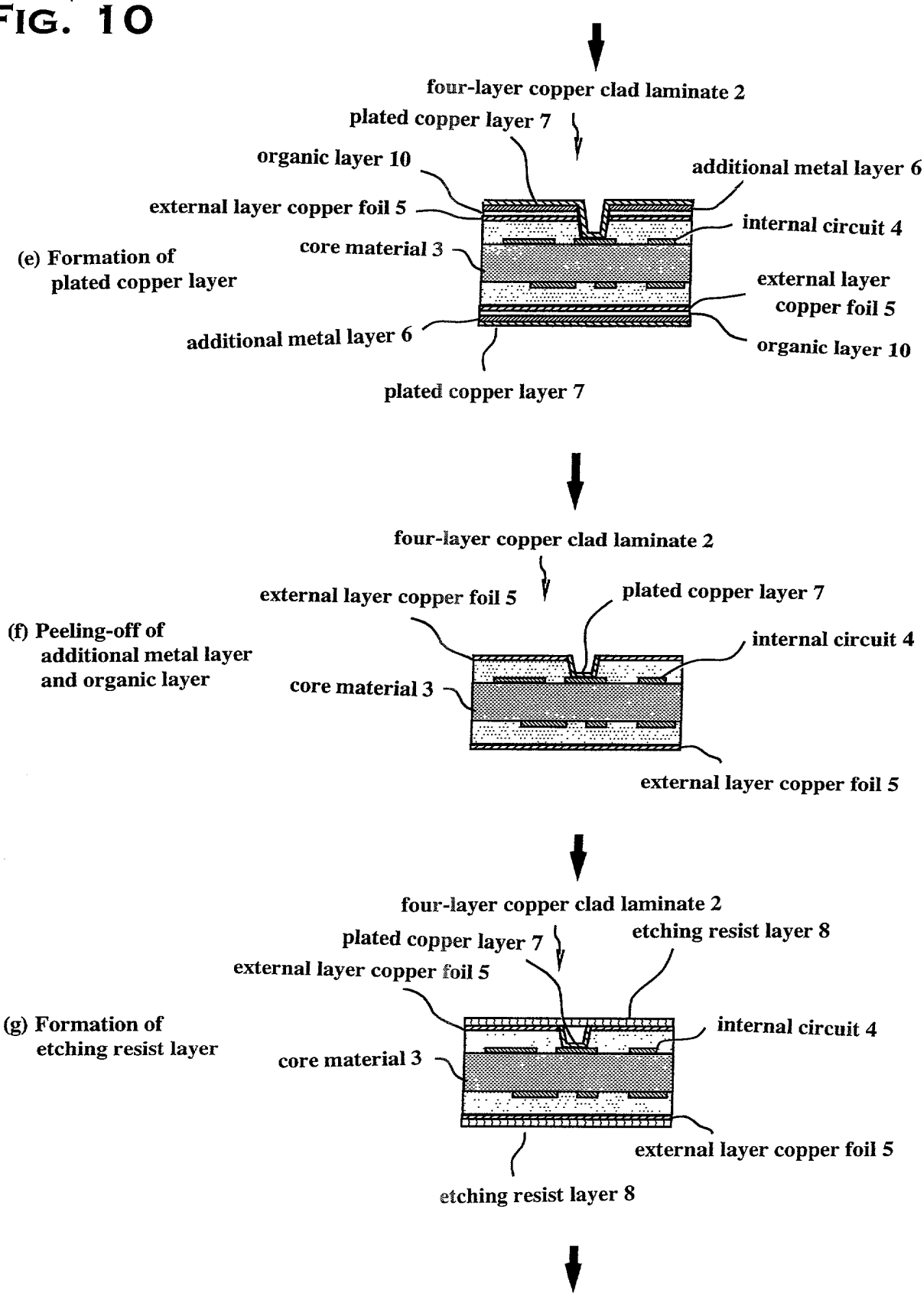
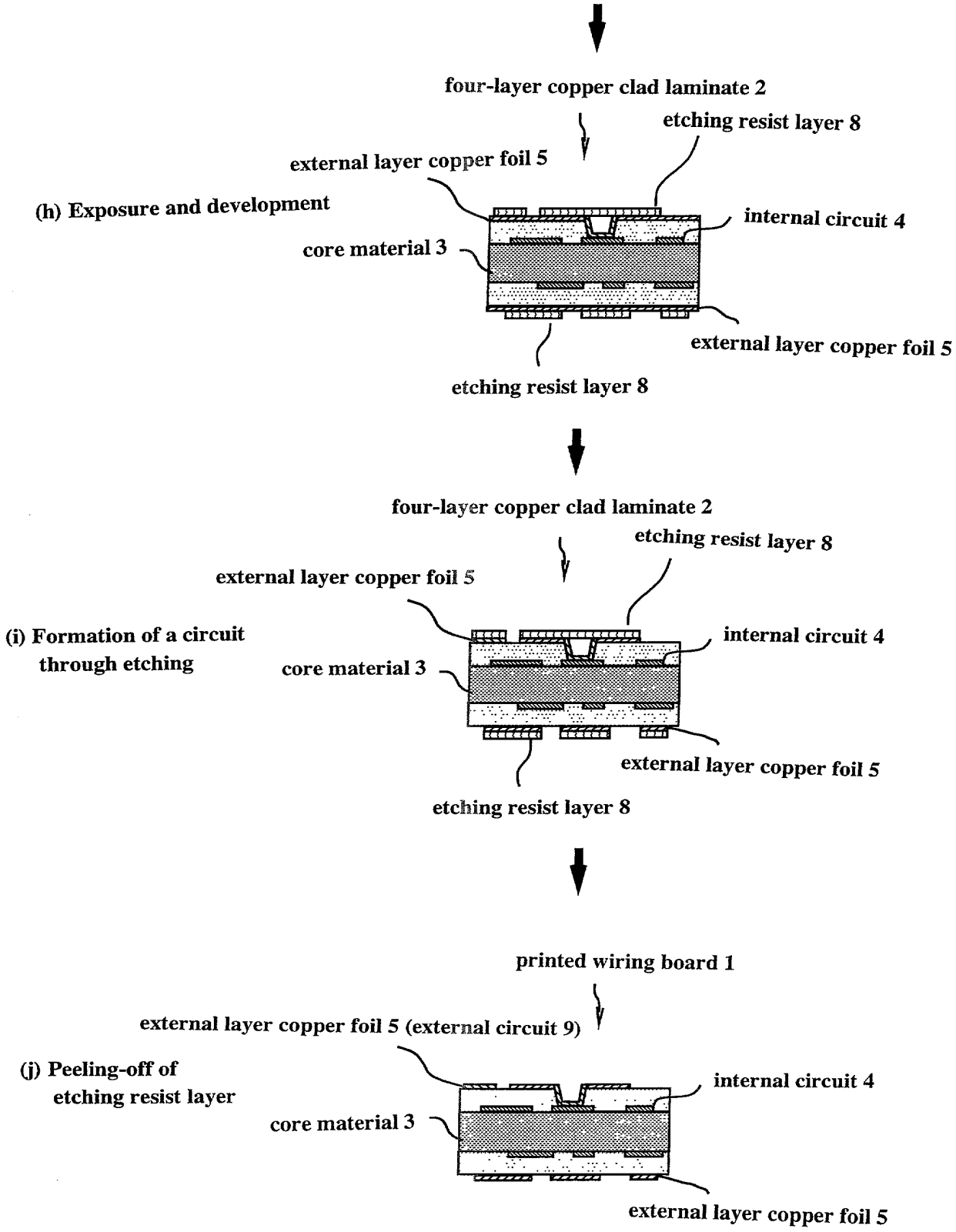

four-layer copper clad laminate 2
plated copper layer 7
organic layer 10
additional metal layer 6
external layer copper foil 5
internal circuit 4
core material 3
(e) Formation of plated copper layer
external layer copper foil 5
additional metal layer 6
organic layer 10
plated copper layer 7
four-layer copper clad laminate 2
external layer copper foil 5
plated copper layer 7
(f) Peeling-off of additional metal layer and organic layer
internal circuit 4
core material 3
external layer copper foil 5
four-layer copper clad laminate 2
plated copper layer 7
etching resist layer 8
external layer copper foil 5
(g) Formation of etching resist layer
internal circuit 4
core material 3
external layer copper foil 5
etching resist layer 8

FIG. 11


four-layer copper clad laminate 2
etching resist layer 8
external layer copper foil 5
(h) Exposure and development
internal circuit 4
core material 3
external layer copper foil 5
etching resist layer 8
four-layer copper clad laminate 2
etching resist layer 8
external layer copper foil 5
(i) Formation of a circuit through etching
internal circuit 4
core material 3
external layer copper foil 5
etching resist layer 8
printed wiring board 1
external layer copper foil 5 (external circuit 9)
(j) Peeling-off of etching resist layer
internal circuit 4
core material 3
external layer copper foil 5